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GOOD ROADS AND CONSERVATION*

By Joseph Hyde Pratt.

Mr. President and Members of the Southern Conservation Convention:

I was very glad indeed to be invited to make an address at the Southern Conservation Convention, and especially so when it was suggested that I speak on the subject of Good Roads in their Relation to Conservation.

It will be necessary for me at times, perhaps, to drift considerably away from the actual subject, in order to make clear certain relations that I feel exist between good roads and conservation.

There is a very close relation between good roads and the successful carrying out of the principles of conservation; in fact, the construction of good roads is one phase of conservation. In the first place, conservation, as applied to our natural resources, means not only their preservation and conservation but means also that we will be able to utilize them perpetually. The problems relating to the conservation of these resources are not local but national and state questions; they are questions that affect and are of interest not only to the individual but to the whole people, and, therefore, in adopting measures looking toward the conservation of these natural resources, the nation must be considered before the state and the whole people before the individual. This does not mean necessarily that the Federal Government should control and dominate all policies relating to conservation; although, personally, I believe that this

*An address delivered before the Southern Conservation Convention, Atlanta, Ga., Oct. 8, 1910.

Printed April 12, 1911.

would be the very best step that could be taken for the most successful accomplishment of all measures relating to conservation. It does mean, however, that the Federal Government should have at least some supervision in the carrying out of these policies so that what is done shall react to the good of all the states and not simply to the individual state and often to the disadvantage of adjoining states. There are so many questions coming up relating to conservation that cannot be applied to the individual state, and the accomplishment of the desired results can only be obtained when they are considered as interstate problems. To illustrate, you might take the question of the protection of forests from fires; one state may pass most rigid laws relating to the protection of its forests from fire and yet the adjoining state may give no protection at all to its forests, and forest fires, starting in this state, gather great headway so that it is almost impossible to prevent their crossing the imaginary state line and doing a great deal of destruction in the state which has rigid fire laws that are being enforced as far as that state itself is concerned. Such a condition can, and does, exist in the Southern Appalachian reign; and, unless all the states will take up the question of fire protection for their forests, there will always be more or less destruction of the forests near the borders of these states from fires that have originated in adjoining states.

Another illustration of the need of some Federal supervision is in the protection of mountain trout from destruction on account of sawdust that is thrown into many of our streams. Many of our mountain streams flow from one state to another and from one county to another and in many instances the counties within a state on the lower waters of a stream have passed rigid laws regarding the throwing of sawdust in these streams and yet the counties higher up on these streams have no such laws, and their lumbermen are allowed to throw sawdust in the streams, with the result that the counties lower down, who have the rigid laws against throwing sawdust into the streams, derive no benefit whatever from these laws as their streams are

filled with sawdust from the counties above. This can also be true where the streams flow from one state to another; one state, on the lower waters of a stream, may have laws against throwing sawdust or other deleterious material into the stream, while the state which contains the upper waters of the streams may have no such laws whatever, and thus the first state looses all of the benefit that its good laws should give.

This is also true in regard to the conservation of waterpowers. One state will pass laws for the conservation and protection of its waterpowers, and yet the sources of the streams are within another state which is doing nothing whatever to protect its water supply, and thus the waterpowers in the other state are largely decreased in power on account of the lack of protection in the state where the streams originate.

From the above it can readily be seen that there should be Federal supervision for carrying out the principles of conservation that are interstate in their benefits, and decidedly state supervision in connection with the conservation of the natural resources of the various counties composing the state.

Every state should be interested in the development of every other state, for no advancement can be made in any one without its being directly or indirectly a benefit to all the others.

We should carry the question of conservation further than its application to our natural resources and apply its principles to the preservation of the health of our people and the conservation of their labor, time, and wealth, and this latter view, it will be found, is fully as important as the first. We will find that good roads play perhaps a more important part in the carrying out of this latter phase of conservation than in the former.

Under the head of natural resources we would have: (1) Soils, (2) Forests, (3) Water-Powers, (4) Products of the sea.

The development, and even the life, of this nation is dependent upon these natural resources, and, while some of them are of less importance than others, yet the best and healthiest growth of the nation is dependent upon the conservation of all

of them. When one stops to consider that the population of this country is now increasing at the rate of about one-fifth of its total population each ten years, one begins to realize how many more millions of people must be fed and clothed from the products of the soil. By the middle of the present century it is estimated that there will be about one-hundred and fifty million people in the United States. This increase is not confined to any one state or territory, but there is a decided and steady increase in all of them. This large growth in population means a constantly increasing call upon all our natural resources; and it is time that we, as a nation, give very serious consideration to their conservation, for we must realize that our responsibility does not rest with providing for the present generation, but we must also do our part toward providing for future generations by conserving and perpetuating for their use the natural resources that we ourselves now enjoy.

The conservation of our soils and forests stands out preeminently as the most vital duty demanded of us, and the carrying out of this to its fullest accomplishment falls principally upon the farmer. The farmer is called the most independent of men, and, in many sections of the country, he is; but in many others he is not, and instead we often find him a very discouraged citizen. If we expect our farmers to take an interest in the conservation of our soils and forests, we must assist them by providing adequate means of transportation for their products and prevent combinations from being formed whose object is to curtail the price received by the farmer for his products and increase the price to the consumer. Upon the farmer rests almost entirely the problem of the conservation of the soil, and his interest will increase in the ratio that we improve the social condition of farm or rural life, and it is in this connection that we will find that good roads play a very important part in improving their condition. Good roads will do more toward improving the social condition of rural life than any other agency that can be inaugurated. At the present time it is possible for the people of our rural sections to have many of the econ-

omic advantages and conveniences of the city,—such as hot and cold water in their houses, lighting and heating systems equal to any in the city, and telephone connections,—at little or no more cost than these same conveniences would cost in the city. Rural mail carriers now deliver mail to the citizens of our rural sections from once to twice a day. Yet with all these conveniences, which many of us now deem absolutely essential and necessary, the farmer, if his home is connected with that of his neighbor and with town by a bad road, is handicapped in his financial and social development, and these many conveniences that have improved his home life lose a great deal of their value in improving the social conditions of the community. It is surprising to note the wonderful uplifting effect that good roads have in a community that has been accustomed for generations to bad roads. It means that houses will be painted, fences will be repaired, flowers and shrubs planted in yards, and, in a number of instances where chicken coops and pig pens were in the front yard, they have been removed to a less unsightly place in the rear of the yard, and it is due to the fact that a good road has been constructed by that farm.

At the present time there is a great deal of thought being given to the problem of keeping the young people, especially the young men, on the farm. Personally, I believe that the construction of good roads throughout the farming sections of our country will do more than any other one thing to keep these young men on the farm. I do not wish to give the impression that I believe all young men who are raised in the country should remain there, for there are many young men raised on the farm who are specially equipped to become doctors, lawyers, ministers, engineers, and business men; yet, there are a great many others who will make much better success in life if they do remain in the country and take up farming as a profession. Many of these young men are now leaving the farms and going to our cities and towns, where they accept positions in stores and mills at low wages and with little prospect of ever bettering their condition to any great extent. These same young

men could, in many instances, have made a splendid success at farming. It is not the work or life on a farm that many of them have objected to, but it has been the isolation of farm or country life. This can be remedied by the construction of good roads, and I am confident that any community or county in many of our Southern States that is now being troubled by its young people leaving the country, can check this exodus very materially if they will arrange for the construction of a system of good roads. It will be one of the very best investments that the community can make, for it will not only help to solve the problem under consideration, but it will also assist in solving the labor problem that is now confronting so many of our farmers.

Our farmers are also closely identified with our forest areas and we will find that there is a decided relation between good roads and the conservation of these forests. As has been stated by Mr. J. S. Holmes, Forester of the North Carolina Geological and Economic Survey, "a forest cannot be managed to the best advantage unless * the inferior species and lower grades of timber can be profitably marketed, and this is only possible where the cost of transportation is low enough to warrant it. The difference between $1.00 and $2.00 per ton for hauling, or the difference between a bad and a good road, will often determine the possibility of profit or loss in marketing timber".

In many of the counties of the Southern Appalachian region the cost of hauling the timber to market is greater than what the owner receives for the timber on the stump. As an illustration of the amount of money that is being expended for the transportation of lumber over our public roads, I will give some figures regarding the sixteen counties in North Carolina west of the Blue Ridge. In this region three-quarters of the area is now in forest, and, probably, the larger portion of this area is better adapted for the production of forest than for any other purpose. During the year 1909 it was estimated by the State Forester that fifteen million cubic feet of timber were hauled to market or to the railroad by wagon over the public roads of these counties. The

* Bull. 8. So. Appalachian Good Road Association, 1910, p. 13.

estimated cost of hauling this timber was $750,000 and in this particular instance it amounts to twice as much as the timber itself was worth on the stump. With this excessive cost of hauling, it can readily be seen that only the most desirable types of timber can be hauled and that the lower grades and the inferior species must be left in the woods. With these conditions, it is only natural that the lumberman should skin the forest of every single desirable tree that he can afford to cut and haul to market, and thus many of the forest areas of the Southern Appalachain region have been almost entirely depleted of many of their most valuable trees, such as black walnut, cherry, yellow poplar, and white oak. There is but little chance of decreasing the length of haul in transporting these forest products, but there is a splendid chance of increasing the load to be hauled by the construction of good roads.

Our farmers are partially at fault for the wholesale waste of our timber, but the states themselves are by far the most to blame for not providing good roads through these forest areas, which would have permitted the farmer to derive a good income from his farm and not be tempted to sell his timber for a mere song. Thus it will be seen that if the forests are to be protected and perpetuated, we must construct throughout the region a system of good roads. There is another way in which good roads throughout these forest areas will play an important part in the conservation of our timber resources, and that is, they will enable automobilists, coaching parties and tourists to travel through these forest areas, who will recognize the importance of these areas to their respective states and it will then be much easier to pass the laws necessary to conserve these forests.

The reclamation of cut-over and abandoned farm lands is much more readily accomplished when these areas are traversed by good roads. Although the farmer may not consider it a profitable investment to reforest his cut-over lands or that portion of his land which he has abandoned for farming purposes, yet he will take up the question of the reforestation of these areas if they are traversed by good roads, for he will

realize that it will improve the general appearance of the country, making it look more profitable and so increase the value of his cultivated farm, by having it surrounded by land that is growing forests instead of land that is being cut into gulleys and looks like wornout, abandoned farm land. With a system of good roads it will be found that many of the farms that are not now being cultivated will be worked and again become prosperous, and thus add to the material wealth of the state in which they are located. It has been said by the Governor of New Hampshire, that since the construction of a system of good roads throughout that state during the past five years, nearly all of the abandoned farms in New Hampshire or at least the majority of them are now again in a state of cultivation. If this can be made true in one state it can be made just as true in another.

From the commercial standpoint the question of the construction of good roads comes closer home to the farmer than to any other class of people, as practically all agricultural products have to be hauled for at least some distance over the public roads, and such a system of roads will do more to conserve the time, labor, and wealth of the farmer than any other one thing. As we know, there is but little chance of reducing the railroad transportation charge on these products, but there is a splendid opportunity in nearly every county of every state in the South to reduce the public road transportation charge. Over many of the public roads of the South it is now impossible to haul a load of more than half a ton. It may be that a considerable portion of the road over which the load is to be hauled is a fairly good one over which one or two tons could easily be hauled, but, on account of the many heavy places and grades on this road, it is impossible to haul over the whole distance more than the half ton, as it is necessary to load the wagon for the rough, heavy places and not for the good portion of the road.

There are many ways in which the farmer will be benefited by a system of good roads besides improving his social condition, and it may be advisable to enumerate these here, as they have

a direct bearing on the improvement in country life, which, in the end, has a direct bearing on conservation, especially in its relation to soils, and also in conserving the time, labor and health of the farmer. A system of good roads connecting farm with market will often permit the farmer to raise certain crops that are more valuable than others, more easily handled, and which will bring a much greater income than he could possibly raise and market where he is on a bad road. I could give numerous cases to illustrate this point, but it is sufficient to state here that it will be found that good roads are a factor in making a farmer realize the necessity of getting the most out of his soil, realize the necessity of studying his soils and the value of rotation of crops.

Another beneficial result that the farmer derives from good roads is that he is able to economize time and force in the transportation of produce between country and market. The distance that the farmer lives from market is not a question of miles, but of the roads that he must travel to reach the market, and of how many hours and how many horses it requires to haul a load to market. When thus measured, ten miles of good, smooth highway is not as long as a few miles of mud and stone. Our farmers are realizing more and more that the distance they live from market is measured in time and not in miles.

Another advantage that improved roads will give to a farmer is that it will permit him to take advantage of market fluctuations in buying and selling, and to take advantage of any special demand that may arise for any of his products. It will permit him to do his hauling at any time of the year regardless of the weather, and thus, when it is too wet to work his crops, he can haul to and fro from town. At the present time in many sections of the country the farmer can only haul to advantage in dry weather, and frequently the dry weather comes just at the time he most needs to work his crop; so that he either loses the opportunity of a demand that has arisen for certain of his products at a good price or has to neglect his crop. In many sections the construction of a system of good roads has

made it possible for farmers living eight or ten miles from large communities to raise garden truck where formerly this could only be produced advantageously within a few miles of a city. The railroads are also greatly affected by the conditions of the public roads in regard to the transportation of farm products, for the reason that on account of bad roads many of our farmers are only able to raise certain crops and are only able to haul them at certain times of the year, which means congestion of freight at the railroads during certain seasons and from 50 to 75 per cent less during the rest of the year. I believe that these conditions in many sections of the country have a decided effect upon the freight rates that the railroads can give for hauling farm produce. Congested freight, which makes it necessary for the railroads to go to extra expense to produce cars with practically no freight at other times, when perhaps their cars are going by these stations empty, causes the extra high freight rates.

A third beneficial result that the farmer derives from good roads, and one regarding which most of our farmers have paid little, or no attention, is the saving in the wear and tear on horses, harness, and vehicles, when these are used over good roads as compared with their cost over poor roads. Then, again, little thought is given to how many days in the year we have to leave our horses and mules standing in the stables on account of bad roads. There is an enormous sum lost each year in this way by nearly every Southern State that can be charged up directly to bad roads. This amount is due to the wear and tear on harness and wagon and the loss of time of those whose living is dependent upon driving and teaming and the loss that a liveryman and farmer sustains when he is unable to work his animals on account of bad roads. This amount in many of the Southern States is from twelve to fifteen million dollars a year, all of which could be readily saved to the states by the construction of good roads.

It will be impossible to carry out the principles of conservation in their entirety until the people are more fully educated

as to the need of conservation, and there is no better place to begin this educational work than in our public schools. Nature studies are already beginning to take a strong hold in many of the schools of some of the states and it will not be long before the general subject of our natural resources will be taken up in nearly all our public schools. The best results, however, along this line can only be accomplished in the better graded schools, and we will find that such schools are dependent upon good roads. Although the one room schoolhouse that dotted this country in its early history, has done a great deal of good in its day, yet, we all realize that a six room schoolhouse, with six teachers, can do better work than six schoolhouses of one room each, where the same teacher is obliged to teach scholars of all ages and attainments. The development of the graded school is dependent upon the construction of good roads, and, although we may not realize it, yet every mile of good road that we build we are increasing thereby the educational facilities of our children.

In closing, I wish to emphasize one point, and that is that while the construction of good roads is one phase of conservation, the maintenance of the road after it is once constructed is a still more important phase of conservation, and one regarding which we are often apt to give but little consideration. Any county or state arranging to construct good roads should always at the same time provide the revenue for the maintenance of the roads after they have once been constructed.

COLLOIDAL CHEMISTRY*

By Duncan McRae

Although the first important work on colloidal chemistry was done in 1861, by Sir Thomas Graham, it is within the last few years that the most rapid advances in this field have been made. Since 1900 not only have a number of chemists been engaged in research on this subject, but the attention of chemists generally has been turned in this direction. This is shown in the number of reports and addresses that have been given on colloidal chemistry. In 1905 A. A. Noyes delivered, as his presidential address before the American Chemical Society, a paper on "Colloidal Mixtures", and in 1908 H. R. Proctor delivered an address on "Colloidal Chemistry" before the British Association for the Advancement of Science.

There have also been a number of German monographs published on the subject of colloids. The research work has been so abundant that nearly every abstract journal contains one or more articles on some phase of this subject. Now, there is a special journal devoted entirely to Colloidal Chemistry, edited by Wo. Ostwald: Zeitschrift fur Chemie und Industrie der Kolloide.

The class of bodies known as colloids is named from one of its most representative substances—glue. Colloid means from its derivation, "glue-like". Some of the best known colloids are: silicic acid, aluminum hydroxide, gelatin, glass, glue, starch, albumen, resin, rubber and gum arabic. Some writers divide colloids into two classes: the reversible and the irreversible. The irreversible lose their colloidal properties on dessication, and become insoluble, but the reversible colloids re-dissolve after dessication. Gelatin is an example of the latter. After drying, it can be dissolved again in water to form a jelly or

*Report before the North Carolina Section of American Chemical Society at Raleigh, June 22nd, 1910.

solution. Silicic acid is an irreversible colloid. This fact is taken advantage of in the determination of silicic in minerals. The gelatinous silicic acid is converted into the insoluble form by heating to drive off all the water.

A. A. Noyes, in his paper, referred to above, classifies colloids in another way. He first defines *colloidal mixtures* as "Liquids or solid mixtures of two or more substances, which are not separated by the action of gravity, however long continued, nor by filtration through paper; but are separated when the liquid is forced through animal membranes, the substance then remaining behind, being designated the colloid". He divides colloidal mixtures into "Colloidal Solutions" and Colloidal Suspensions." Solutions are viscous, gelatinizing, and not coagulated by the addition of salts. Colloidal suspensions are non-viscous, non-gelatinizing, but readily coagulable. Colloidal solutions possess characteristics of true solutions: osmotic pressure, diffusibility, and usually a limited solubility of the colloid at some temperature. Colloidal suspensions do not have these properties of true solutions, and manifest many similarities to macroscopic and microscopic suspensions. Prof. Noyes says, in giving this classification, that when more is known about the behavior of colloids, it is probable that this classification may be found to be one of degree rather than a distinction based on some very fundamental difference.

It seems to the writer of this report that a better classification than either of the above may be found when colloids have been studied more extensively.

The distinction was originally made between colloids and crystalliods. In recent years however, a number of crystalloids like sodium and potassium chlorides and barium sulphate, have been prepared in colloidal form. So that now the distinction is made between two different states rather than between two classes of substances.

The important properties of substances in the colloidal state are: (1) When dry they are amorphous and show a conchoidal fracture. (2) They form two classes of physical compounds, with

liquids: jellies, and colloidal solutions. These are technically called "gels" and "sols". Gelatine furnishes an example of each. If it is dissolved in hot water we have a colloidal solution. When this solution cools it forms the semi-solid mass called a jelly or "gel". (3) When a colloid is heated with water and it expands to form a jelly, it exerts a very great force. This force has been calculated for starch by the use of Clausius's equation for bodies expanded by heat, and found to be 2073 kilos. per sq. cm. The expansion of colloids by water is a reversible and cyclical process, therefore Clausius's equation is applicable to it. The great force exerted by swelling wooden wedges used to split rock, has been explained as this colloidal expansion. (4) Colloidal substances are permeable to crystalloids but are more or less impermeable to other colloids. Dialysis is based on this property. The mixture of colloids and crystals which it is desired to separate, is placed in a bag made of an animal membrane, which is a colloid. This bag is then placed in running water. The crystalloid then passes through the membrane and is removed by the running water; the pure colloid remains in the bag. (5) When an electric current is passed through certain colloidal solutions the colloidal particles migrate towards the anode; particles of other collodial solutions migrate towards the cathode. It has been found that when solutions that migrate to different electrodes are mixed, they precipitate each other; while colloids migrating to the same electrode have no effect on each other. Colloidal solutions also coagulate on the addition of a very small quantity of an electrolyte. Often, though, an electrolyte which preciptates one colloid will have just the opposite effect on another, causing its gel to go into solution. When a colloidal solution is precipitated by an electrolyte, it is found that a very small amount of one or the other ion of the electrolyte is carried down with the coagulated colloid, and that on analysis of the solution, a corresponding amount of the same ion is lacking; (6) The property of colloids that has probably the widest technical application is that of adsorption.. Colloids may take up and hold acids, salts, etc., in such quantity that the result-

ing products may be mistaken for chemical compounds. This is the case with basic ferric arsenite 4 Fe_2O_3 As_2O_3 SH_2O, and a number of complex mineral silicates, which are now considered to be absorption compounds. The collodial solution of palladium absorbs about three thousand times its volume of hydrogen. Dyeing is largely an adsorption process, the dye being absorbed by the colloidal threads. (7) When observed with the ultramicroscope the particles in colloidal solutions range in size from very nearly that of the estimated size of the hydrogen molecule to hundreds of times as large. They all exhibit the Brownian movement which rapidly increases with decrease in size of the particles. (8) If a small amount of a reversible colloid (not enough to appreciably increase the viscocity of the solution) be added to a colloidal solution of gold, it makes the gold solution more stable, ie., less liable to coagulation. Also hydrochloric acid produces only an opalescence in silver nitrate solution containing a small amount of gelatin*

In general the addition of a small amount of a reversible colloid seems to prevent coagulation or the growth of crystals. It has a wide technical application.

The methods of preparation of colloidal solutions may be of interest. There are four general methods: (1) by simple solution as in the case of gelatin and albumen; (2) by electrical subdivision; Bredig prepared his colloidal solutions of the metals by forming an electric arc under water, between electrodes of the metal, whose colloidal solutions he wished to prepare; (3) by adding a small amount of an electrolyte to an insoluble jelly. The proper electrolyte causes it to be dissolved. For instance: stannic hydrate is rendered soluble by the addition of a drop of ammonia; (4) by chemical reaction in a solvent in which the resulting product is very insoluble.

Colloidal barium sulphate is prepared in this way by precipi-

*Experiment. Two portions of silver nitrate in one of which is dissolved an empty gelatin capsule obtained from a drug store, are precipitated with HCl and filtered. Filtrate from the one containing gelatin is opalescent, the other is clear.

tation in glycerol. The alkali halides are prepared in colloidal form by precipitation in methyl alcohol.

So far I have given the most important properties of substances in the colloidal state and the general methods for their preparation. As colloidal chemistry is still a very new field the different workers are by no means agreed on the correct explanation of all the phenomena, I will try to give one or two of the most generally accepted theories concerning colloidal solutions and gels. Any such theory must offer an explanation of the electrical behavior of colloids, the movement of the particles, and their coagulation.

Most of the writers on colloids, though they express the fact in very different ways, agree that colloidal solutions form a regular transition from suspensions to ordinary solutions. That is to say, we can start with a suspension that settles out on standing, and by taking other suspensions of smaller and small particles, we can pass through colloidal solutions and finally when the particles consist of one molecule, arrive at ordinary solutions. The particles acquire an electric charge (by contact in a manner similar to the acquisition of a charge by glass rubbed with silk) by contact with the liquid, and as the particles become smaller and smaller the influence of this charge becomes very large in comparison with the influence of gravity, the Brownian movement then appears as the result of the mutual repulsion of similarly charged particles. As the particles become smaller and smaller, this motion increases very rapidly and prevents the settling of the suspension. When the particles approach the size of molecules the rapidity of the motion is enormous and we have crystalloidal solution.

The coagulation that takes place when two colloidal solutions of opposite sign are mixed is supposed to be due to the neutralization of the electric charges and the consequent cessation of the movement of the particles. When the motion ceases the attractive forces of the particles and gravity cause the settling.

The explanation of the character of the colloidal jellies is that they have a cellular, sponge-cake structure, the solid part of which is a solid solution of the liquid in the colloid. The

spaces in between the solid part, corresponding to the pores of the sponge, are filled with a liquid solution of the colloid in the liquid. The tremendous force exerted by the swelling colloid is generally ascribed to molecular forces. Different writers are not agreed as to whether the mechanism of this force obeys capillary, surface tension or osmotic laws. Adsorption is also explained by this structure and these forces.

Some of the practical applications of colloidal chemistry will now be mentioned. First of all, its application to the study of physiology can be seen when we think that the whole body is made of colloidal substances. The blood has been found to contain in soluble form the same colloids that appear in the muscles and tissues. Colloidal jellies are used as media in which bacteria are studied. Nearly all foods are colloidal substances. From the number of references in the literature to medical journals I should say that the physiological application of colloidal chemistry was certainly one of its most important ones. Since this paper was written, a very interesting article, "Some Colloid-chemical Aspects of Digestion, with Ultramicroscopic Observations" by Jerome Alexander, has been published in the Journal of the American Chemical Society.

The process of dyeing different kinds of fabrics is, in most cases, colloidal adsorption. A mordant is used to deposit a colloidal jelly in the thread and this absorbs the dye.

The artificial silk industry which now produces 50 per cent. of the silks sold, depends largely on colloidal processes. The cellulose is obtained in a soluble form and again coagulated in the form of very fine threads.

Celluloid, rubber and starch are colloids and consequently their manufacture is concerned with colloidal processes.

Photographic plates are coated with a colloidal solution of a silver salt in nitro-cellulose. One kind of photographic paper is simply a piece of paper coated with a mixture of potassium dichromate, a pigment and gum arabic. Under the action of light this mixture becomes insoluble.

Ice cream is given a smoother taste by the addition of a small

amount of a protective colloid like gelatin. The gelatin prevents the formation of large ice crystals. A small amount of gelatin, albumen or gum arabic is added to candies to prevent the crystallization of the sugar. This is done in making marshmallows caramels, etc.

In the manufacture of pottery, tannin is added to the clay to make it more workable. The tanning industry is concerned with colloidal chemistry. In electroplating, a small amount of protective colloid is often added to prevent the formation of crystals and to give a smooth coating to the plating. The coloring of glass is a colloidal process. The colored glass being a colloidal solution of a metal. Ruby glass is a solidified colloidal solution of gold. These applications will serve to show the importance of this field of chemistry.

In conclusion, I wish to thank this section for having made me its reporter. It has been a pleasure to me to study this subject, and I hope that some of you may be interested in this new and interesting field of chemistry.

A RECOLLECTION OF PROFESSOR W. K. BROOKS WITH CRITICISMS OF SOME OF HIS WORK*

By H. V. Wilson.

In going over my memories of Dr. Brooks I find that my mind does not separate him from his environment. I continually see him in the semi-communal life of the laboratory, whether in Baltimore or Beaufort, Woods Hole or the islands of the West Indian sea, which so stirred and charmed him. Even his home life with its restful, satisfying beauty was but a detached fragment of the other larger existence. I think of him as the central figure, wise and kind, of a circle of young men coming from many quarters, from New England, the Middle States, the West and the South, from Canada, England and Japan, a society from which older members were always going out to honorable careers and into which new were coming to learn the ways and traditions of the school. Very different were we, but knit together from the start by the strong bond of a common interest, and presently by growing appreciation of him who made the school. It took us but a short time to learn that here was no mere work-shop, well organized and in which we might acquire the requisite degree of skill in a profession, but that we were in the company of a master mind, wide ranging in the fields of knowledge and inquiry, profound in contemplative thought, and with the acuteness of the observer who discovers what has been hidden.

As I dwell on the man and try to single out mental habits and attributes from the whole of his personality, I come to many that arrest and enchain my attention.

It is interesting to consider his practice and advice to begin-

*From the composite biographical sketch in the Memorial Volume to William Keith Brooks (Journal Experimental Zoology, special volume 9).

ners in the study of Nature. It was to start out, not from a general principle, but from some phenomenon that had caught the eye and become a nucleus for thought. Continued persistent observation and reflection circling round such a center would yield, he held, solid results in the shape of new facts and would sooner or later lead one into living contact with great questions. This method of work was eminently characteristic of his independent, individualistic temperament.

The serenity of Dr. Brooks impressed every one. In a mind so strong, active, and keen, calm temperateness was doubly noticeable. This peace of mind must have been due in part to the fact that his critical insight was unobscured by selfseeking. A firm gaze fixed on the distant goal held the immediately advantageous in its proper place, and gave him a confidence, a quiet boldness that we all recognized.

Brooks frequently said that he tried always to be a reasonable man. And in dealing with men and their ways I am convinced that reasoning did guide him in a remarkable degree. His logical habit of thought came in, however, for more congenial exercise in professional work. Do we not all remember the pleasure he had in the skilful disengagement of the idea from the mass of details, and in its portrayal, language and drawing mutually contributing to clearness?

I recall also his strong and helpful faith in the value of labor spent in searching out the order of the universe, the way things happen in nature. For, as he often said, such knowledge both makes the conscious life of man fuller and nobler, and is the basis on which rests all our control of natural phenomena.

The machinery of Professor Brooks' department, the lectures, set tasks and routine, was simple. Experience has shown, however, that it was not inadequate, on the contrary, that it was well adapted to the purpose in view. Brooks' underlying assumptions were that graduate students had come to stay some time, would work as hard as they could, and that they had enough independence of mind and enough elementary training to handle books and journals which record the actual state

and progress of zoology. Of lectures there was one now and then from Professor Brooks on any subject. A round of lectures by older students in the department was given some years, and this was excellent practice.

The journal club was serious. It met weekly and the arrangement was such that each graduate student reported a number of times during the year. A reading club met weekly in the evening at Professor Brooks' house. Some pleasant book of general zoological interest, often one of travel, was read, after which came tea. In the laboratory again once a week readings of a more serious nature and with some discussion were held. The "Origin of Species" was in this way gone through, and "Agassiz's Essay on Classification."

Professor Brooks had compiled an elaborate list of the literature, with which it was supposed candidates for the doctor's degree were to make themselves familiar. It included the textbooks of the period and important memoirs on the various subdivisions of zoology. The list was long. Perhaps some students completed it. But we all read with considerable diligence and it was the custom to make careful abstracts. On the basis of this common reading a good deal of informal talk and discussion was maintained among us.

We lived in the laboratory all day and the young men learned much from the older, especially in matters of technique. Brooks gave excellent suggestions on drawing and would occasionally go through the form of taking a micro photograph. A beginner in my time was usually given some material, referred to a paper or two on comparative anatomy or embryology, and told to verify the research. At intervals, frequent enough, Brooks looked at his figures, notes, and preparations and had something to say about the matter. Frequently before the first testing and forming exercise was completed, the man would be put at another. Two or three filled the year. Then came the long season at the seaside laboratory, in all probability the first for the student and teeming with experience. There was daily collecting, much study of living animals, much rearing of embryos

and larvae. The pelagic fauna got in the tow net or at times by dipping came in for a good deal of attention. Numerous quick dissections were made, and quantities of notes and drawings. Brooks exercised little or no supervision over such work, but the older men were a great help to the younger. The larger manuals such as Balfour's Embryology, and later Korschelt and Heider, were fairly thumbed. The industry and "go" of Brooks' summer laboratories were remarkable, the lamps lit in the evening, and some one frequently sitting up all through the night to "follow a development." Toward the end of the season, when a little perspective had been acquired and mere mass and variety began to pall, a special form or two was singled out as promising something in the way of new results, and the path of research was thus opened up. The material so collected was studied in detail during the folllowing winter. More intensive reading bearing on the problems as they became defined was undertaken. Informal, short, but helpful talks about the work were had with Brooks from time to time. He would examine particular preparations, quickly to be sure, or would criticise figures. There was never any leading or "nursing" on his part. By the end of the year, though, some grasp of the methods of research had been acquired, and the following summer at the seaside usually found the student able to pursue the line of inquiry on which he had started, or to strike off into an associated field.

Studies on Heredity. As early as 1876 in a paper entitled, "A Provisional Hypothesis of Pangenesis" Brooks began to deal with questions of heredity and variation. His thinking in this direction took shape and led in 1883 to the publication of a volume under the title of "The Law of Heredity." The central point in the theory he presented is the conviction that the reproductive elements are, contrary to the usual opinion, not alike in function. In support of this conclusion the author draws arguments from the facts that hybrid offspring resulting from reciprocal crossings are often very different; that the offspring of a male hybrid and the female of a pure species is much more

variable than the offspring of a female hybrid and the male of a pure species; that a structure which is more developed or of more functional importance in the male parent than it is in the female parent is very much more apt to vary in the offspring than a part which is more developed or more important in the mother than it is in the father. These and other facts convinced Brooks that the ovum and sperm cell are not only different morphologically, but that they differ profoundly in function as well.

In developing this idea into an explanatory theory of the way in which hereditary transmission is accomplished, Brooks borrows from Darwin's hypothesis of pangenesis, and assumes the existance of material particles, "gemmules" which are thrown off from the body cells. Unlike Darwin, however, he assumes that such particles are only thrown off at particular periods, when the body cells are disturbed in function through some change in their environment. The gemmules may penetrate an ovum or a bud, but it is the male germ cell which has gradually acquired during the evolution of the metazoa the peculiar power to gather and store up gemmules. The ovum on the other hand has acquired a very different nature. It contains material particles which correspond to the hereditary characteristics of the species. Thus in the case of a fertilized egg, as in that of a parthenogenetic egg, the great bulk of the development is due to the properties of the ovum itself. The gemmules brought in by the sperm cell unite with homologous particles in the ovum and so composite particles are produced which, as the egg segments and develops, give rise to cells that are strictly hybrids and which therefore exhibit variation. The ovum thus is the conservative element which transmits the characteristics that have already been acquired. The male cell is peculiarly that which stores up the disturbing effects of a changing environment. It especially leads, therefore, to variability in the offspring, to the production of individual differences.

This ingenious hypothesis enables Brooks to explain a great variety of inheritance phenomena and to overcome several serious

objections to the unassisted selection theory. Whatever truth there may or may not be in the special ideas of the book, it remains today a stimulating and suggestive contribution, and it is properly looked on as one of the factors that have in recent years focussed the attention of the biological world on the problems of heredity.

Minor papers dealing with heredity and evolution, the causes of variation, and the determination of sex, appeared from time to time. Sections of the "Foundations of Zoology" (1899) show too that Brooks' interest in the questions discussed in the "Law of Heredity" remained active during life. Two of his last addresses (1906, 1909) deal with our concepts of heredity and variation. In these he emphasizes the fact that the nature of an organism is not implicit in the egg, or in the organism indeed at any time of its life, but that it depends on a continuous reciprocal interaction between the organism and its environment. Such interaction leads in any particular case to a result which could not be calculated from a knowledge, however complete, of the egg itself since it is dependent not only on the organism but on the action of the total environment. The outcome of such interaction is the production of individuals which are never quite alike, although they may resemble one another closely. The occurrence of likenesses, or inheritance, and the occurrence of differences, variation, are thus not two processes but two views of the single process of reciprocal interaction. The idea that they are distinct is an error into which we fall through concentrating our attention at one time on the resemblances, and again on the differences between individuals. These considerations, he thinks, show the uselessness of theories which postulate an inheritance substance and explain individual differences as the result of various combinations of its particles.

These addresses show that Brooks has in some measure shifted his standpoint since the time of the "Law of Heredity". He no longer is in a mood to employ evolution (determinant) hypotheses to account for development. He now looks on the development of the individual, and that of races also, as epigenetic

in nature. What will be the outcome of an individual egg depends on the interaction between egg and environment, not on a determinate mechanism in the egg. The pre-cambrian fauna has given rise to the living beings of today. But the latter were not implicit in the former, for with the same ancestors the course of evolution might have been different had the sum total of the environmental influences been different.

Writings on the Principles of Science. Brooks dwelt often in conversation and in minor writings, and always with an earnest pleasure, on the nature and intellectual value of what we can learn. His thoughts in this field of the principles of science were eventually embodied in his lectures on the "Foundations of Zoology" (1899). This remarkable book "belongs to literature, as well as to science. It belongs to philosophy as much as to either, for it is full of that fundamental wisdom about realities which alone is worthy of the name of philosophy."

The "Foundations" is essentially a discussion of the nature of scientific knowledge. It is the wise talk of an experienced, reflective naturalist of ripe years addressed primarily to younger fellow-workers in the fields of science. The argument which makes its way through pages and sometimes whole chapters of illustrations and digressions, interesting and suggestive in themselves, proceeds about as follows:

Our knowledge of nature comes through experience. Through experience we learn that one sort of event follows another, and this sequence, which we come to expect, constitutes for us the order of nature. Nevertheless there is no reason to believe that there is an inherent necessity in this order, for we never perceive the presence of any intrinsic causal connection between the preceding event (cause) and the succeeding one (effect).

When our knowledge of any part of nature has so far developed that we know the order of events, and so can predict the later steps in the series of occurrences, once the earlier have been noted, we say that we understand and can mechanically explain that particular set of phenomena. At present a gap separates vital from non-vital phenomena—to say that life is the sum of

the physical properties of protoplasm is to make a dogmatic assertion, although to gainsay it is to make another. But with the progress of science this gap may be bridged over at some time. Should it be bridged over, and life in all its aspects be found to be "protoplasmic", still we should not know *why* synthesis of compounds results in an organism or *why* a vital action is the outcome of protoplasmic changes. In respect to organisms and vital actions we should still be where we are now in respect to simple gravitation phenomena, for with respect to them all that we can say is that the stone will fall (if the future be like the past), but why it should fall we do not know.

This being the nature of our knowledge, present and future, what should the biologist seek to discover, and what are the problems that peculiarly concern him? Life is defined as a continuous adjustment of internal to external relations (Spencer), and it is pointed out that synthesized protoplasm, even were it capable of nutrition, growth, reproduction, and contraction, would not be a living thing if it were not also able to maintain persistent adjustment to the shifting world around it. The essence of the living thing and that which distinguishes it from other forms of matter is this very adjustment. Fitness, adaptive response, is therefore what we should seek to study in biology. The mechanism itself is of subordinate importance. Study it as we may, we cannot thus go far forwards, since our knowledge of nature never includes a perception of any necessary causal connection between events, such as would make it possible to discover vital phenomena by reasoning deductively from protoplasmic peculiarities. A corollary of practical import is that the naturalist should endeavor to study living things in connection with their environment.

Biology being thus defined as the study of adaptive response, the nature and evolution of man's reason and knowledge fall within its scope. For these are conceivably but the outcome of adaptive responses in the beginning as simple as the geotropism of a seedling's radicle. The ability, for instance, to make a distinction between what in practical life we call a truth, a real occurrence, and an error or illusion, is to be looked on as a

useful response that has been acquired through selection. Man's knowledge, then, is of the peculiar kind that is useful to him. He may not yet know as much as is good for him, but he at least has acquired a store of the kind of knowledge that preserves him in the struggle for existence.

Viewing man thus from the biological standpoint Brooks attempts to deal with two human characteristics, the consciousness that the will is free and that the individual carries a moral responsibility. These, like all other vital characteristics, he thinks, may possibly sometime be shown to be a part of the order of nature and in that sense mechanical. "Rational action may sometime prove to be reflex from beginning to end." And yet in the face of this possibility, Brooks would still maintain that the will is free and moral responsibility real. To some this will seem a difficult thesis.

Underlying the scientific inquiry as to the character of our present knowledge and of that which possibly we may acquire about nature, is the metaphysical question, "What is nature?" This question Brooks does not attack in the fashion of constructive technical philosophy. He makes no attempt to define reality. His purpose in dealing with the matter is plainly the practical one of showing us what we need not believe. He says in effect, if then our knowledge of all nature is and will continue to be of one sort, that phenomena follow one another regularly and (supposing the future to be like the past) in predictable fashion, but without our ever learning why they so follow one another, there is not now nor will there be in the future any necessity drawn from science to believe in a fixed, necessary, determinate nature. If in any quarter it is imagined that the progress of science necessitates or may necessitate such a belief, this is a grave error: in his own words, "The belief that the establishment of scientific conceptions of nature shows that after the first creative act, the Creator has remained subject, like a human legislator, to his own laws, is based upon utter misapprehension of science, and upon absurd and irrational notions of natural law." In the second place we are in no wise forced to believe by anything in science that protoplasm

and life are necessarily linked together: "* * * if it be admitted that we find in nature no reason why events should occur together except the fact that they do, is it not clear that we can give no reason why life and protoplasm should be associated except the fact that they are? And is it not equally clear that this is no reason why they may not exist separately?"

The next step in this survey and analysis of fundamental aspects of nature brings us to positive belief itself. As so often said, science quite fails to find in matter and motion any intrinsic virtue which sustains and directs the sequence of phenomena, and is absolutely restricted to the discovery of the mere sequence which itself calls for (metaphysical) explanation. Hence there is nothing in science which has any bearing on the causal origin or on the reality of anything in nature, and we must go elsewhere for the foundations of the belief that we may entertain in respect to such matters. Brooks believes that "nature is intended" to be as it is, and is a language which a rational being may read. Since the rational being is perhaps himself a part of nature's mechanism, this is equivalent to saying that one part of the mechanism is cognizant of the purpose that animates the whole. This purpose is the effect of a power, a sustaining and directing intelligence outside nature, to which both the origin of nature and its maintenance from day to day are due. It is not something which once for all set a determinate cosmos spinning along the path of time with a full complement of "eternal iron laws." It is something which is at work now, under every phenomenon. This is obviously Brooks' belief, although being no propagandist he is far from enforcing it, indeed leaves it in a measure to be inferred. What he wishes to make plain is that science does not tell us why events happen as we learn they do, and so it tells us nothing of ultimate reality. The question why the events we expect (from experience) should be those that come to pass, concerns not science but "the natural theologian; for it is the same as the question, What is the cause of Nature? To this all must seek an answer for themselves; for each has at his command all the data within the reach of any student of science."

RECENT FOREST REPORTS OF THE N. C. GEOLOGICAL AND ECONOMIC SURVEY

By Joseph Hyde Pratt

Two reports have recently been issued by the North Carolina Geological and Economic Survey relating to the forests of this State. The first of these is a report on Forest Fires in North Carolina during 1909, by J. S. Holmes, Forester of the Survey, published as Economic Paper No. 19. The statistics given in this report were collected in co-operation with the United States Forest Service. This report has been issued on account of the enormous loss North Carolina sustains each year as the result of forest fires, and it gives the result of an investigation regarding the number of forest fires, the amount of damage they did, their causes, and whether it would have been possible to have prevented any of them. Although the Survey was not able to obtain as full information as was desired, yet the statistics given are of considerable importance and show the need of some legislation to prevent, as far as possible, this enormous waste that is caused each year by forest fires.

Fire is undoubtedly the greatest enemy to the forest. It has been estimated by the National Conservation Commission that in the United States the loss by fire on standing timber for the past thirty years has averaged $50,000,000 a year, and this takes no account of the destruction of young growth. The statistics for 1909 showed that North Carolina sustained a loss of over $500,000 from forest fires. The fires which caused this damage were chiefly due to carelessness. To overcome this careless attitude on the part of the people and interest both private effort and state co-operation in the fight against forest fires, public opinion on this subject must be awakened.

The second report is on the Wood-Using Industries of North Carolina and was prepared by the North Carolina Geological

and Economic Survey in co-operation with the United States Forest Service. It was prepared by Roger E. Simmons, under the supervision of J. S. Holmes, of the North Carolina Geological and Economic Survey, and H. S. Sackett of the United States Forest Service, and is published as Economic Paper No. 20. This report deals with the Wood Using Industries of North Carolina as follows:

(1) Those manufacturing directly from the log a finished product, which cannot be changed by any further process of manufacture, such as excelsior, handles, veneer boxes, or mine rollers; (2) those using rough lumber and by the application of skilled labor and wood-using machinery convert it into such finished products as furniture, boxes, flooring, etc. The various tables in this report show the sources of the wood used, the kinds of lumber demanded by the wood-working factories, the price paid for each species delivered, the quantity consumed, and the purposes for which it was used.

An investigation of this character should be of value in a number of ways. To the State of North Carolina it should be of considerable assistance in forming an intelligent forest policy, and in presenting the advantage the State offers to wood-using industries to locate in it. The timber owner, and even the farmer who has a few scattered trees to sell, can learn from this report where a market can be found. To the sawmill operator it may suggest a use for wood which he previously considered of little commercial value. To the manufacturer who is under the necessity of looking beyond his own State for all, or part of the lumber needed, it will furnish a source of fairly accurate information concerning a region most likely to supply his needs. The merchants throughout the country who handle wood products can study to advantage the report of what North Carolina has to sell or wishes to buy. For the people at large it has a statistical value, and gives much general information.

It gives valuable information concerning the forms, uses, and grades in which the factories desire the lumber, and also the woods most suitable for specific uses. The chief purposes

of this report are to give needed information regarding these industries, to stimulate trade by bringing together buyer and seller, and to show the citizens of North Carolina the wisdom of perpetuating her valuable wood-using industries by the adoption of an intelligent forest policy. Two appendices have been added to this report. The first gives a list of the different kinds of woods that are found in North Carolina, together with the various purposes for which they are used, and the second appendix gives a list of the wood manufacturers of North Carolina under the heads of the products which they manufacture.

The value of the timber crop in North Carolina is exceeded only by that of the cotton and corn crops. According to the United States Census Bureau, the value of the lumber cut in this State amounted in 1908 to $15,000,000.

The foregoing report shows that half of this lumber was purchased by firms in this State and manufactured by them into a finished product. For this lumber, together with a small amount of logs, billets, and timber in other forms which they used, these firms paid something over $10,000,000.

This enormous industry has been dependent for its supply of raw material almost entirely on timber that has grown up under natural conditions, the present owners being in no way responsible or assisting in its production, much of the timber having been growing for 200 to 300 years. As the old timber disappears, and it is rapidly doing so, the methods of the producers will have to change; either this timber will have to be procured outside the State or these large and valuable industries, second only in importance to cotton manufacture, will have to shut down.

As long as both the growing and manufacture of this timber can be carried on profitably in this State we cannot afford to give up either part of this two fold industry. North Carolina probably contains as large a proportion of mountain land specially suitable for the growth of hardwoods, which is what most of these industries require, as any other State. We can, therefore, grow the raw material more cheaply, and furnish

it to these factories at a lower price.

This report is intended as an incentive to improvement and as an aid in bringing about better conditions, partly in demonstrating the value of our forests to the people of the State, but chiefly by enlarging the market for the lower grades of wood by letting other parts of the country know what North Carolina can furnish them.

By protecting the forests from fire so that the annual rate of growth can be continually increasing, and by closer utilization, thus preventing waste in the woods and at the mill, there is no reason why the annual yield of our forests cannot, after a comparatively short time, be doubled.

If as much care and foresight were exercised in the growing, protection, harvesting, and marketing of the raw material as is now given to the manufacture of the finished product, there need be no fear of an impending timber famine on the part of the wood-using industries of North Carolina.

JOSEPH AUSTIN HOLMES*

By Collier Cobb

The director of the recently established Federal bureau of mines illustrates the helpfulness of a proper heredity by an advantageous environment. But this environment has been one that his heredity forced him to seek, and his own rigorous interaction with whatever environment he has made for himself, has been effective in placing him in charge of one of the most important bureaus of our government. He has risen to the directorship of this bureau, which his own energy has created, by sheer force of merit, when all political odds and party expediency seemed against his appointment. If that education is best which gives one the power to select his own environment and then bring about the adaptations, one has to look far afield before finding a better educated man than Joseph Austin Holmes.

Born at Laurens, S. C., November 23, 1859, son of Rev. Z. L. Holmes and his wife N. Catherine Holmes, born Nickles, Joseph A. Holmes came of the best Southern stock. For generations he had been well-born, his family on both sides having always been people of character, means and position. Coming into the world in South Carolina just before our civil war, his childhood and youth were spent under circumstances well calculated to try the mettle of a boy, and in the duties of the home he early came to bear a man's part.

The son of a Presbyterian preacher, who was himself a lover of nature, the boy was reared in a home of culture and refinement. The home was a large octagonal house made of reinforced concrete, occupying the center of ample grounds on the outskirts of the village, and having every convenience that the ingenuity and skill of its occupants could devise and supply. The house was supplied with running water, which a hydraulic

*Reprinted from the Charlotte Observer.

ram brought up from the branch. This was true of the Holmes home at a time when the trains that came into the sleepy little village ran from Alston over wooden rails capped with strap-iron. But the home had an excellent library, and one could see in it here and there instruments and appliances for the study of the realm of nature, most of them made in the workshop of the home. The writer recalls especially a high-grade telescope made and mounted by the minister himself.

One son from this home became a lawyer, but later entered the ministry of the Presbyterian Church. The children got the best of their instruction at home from their parents, but they also attended the Laurens Acadamy, famed in its day for the thoroughness of its instruction. Joe, who was skilled with his fingeres and handy with tools, went to Cornell, where he made his own living and took his degree of Bachelor of Agriculture in 1881, with visions of rehabilitating the barren farms and mending the broken fortunes of his stricken State.

Immediately upon his graduation he was elected to the professorship of geology and natural history in the University of North Carolina, and entered upon the teaching of subjects that now require the entire time of nine specially trained men. As soon as he had acquainted himself with the geography and geology of the State, he began an active campaign for the reorganization of the North Carolina Geological Survey and for the building of good roads throughout the State. In both endeavors he was eminently successful. The State survey was established in 1891, when Prfessor Holmes became State Geologist; and from 1885 to 1900 he increased the annual tax money for public roads from ten thousand dollars to three quarters of a million dollars, thus adding more than a thousand miles of macadamized roadway to the capital of the State.

Professor Holmes was the most public-spirited citizen of Chapel Hill. He was a member of the board of aldermen, and interested himself especially in the sanitary condition of the town and in the grading and macadamizing of the streets. He carried around with him less of himself and more of the work

in hand than any other man I have ever known. He literally lived in his work, without the least regard to its relation to himself. So true was this that, while State Geologist, he more than once spent so much of his annual appropriation in prosecuting the work of the survey that he did not leave money enough to pay his own salary.

While professor in our University he secured the passage by Congress of a bill appropriating money for the building of a marine biological laboratory at Beaufort for the use of the United States fish commission. By some oversight, the bill did not carry an appropriation for the purchase of the ground on which to erect the building. But Mr. Holmes invited a number of universities to contribute to the purchase of an island in Beaufort Harbor on which to build the laboratory, the place affording exceptional opportunities for study as it is the meeting-place of the Northern and Southern fauna and flora of the sea. The Universities of Virginia, North Carolina, South Carolina, Georgia, and Johns Hopkins responded liberally. The island was purchased and presented to the government, and now each season sees a number of trained men carrying on at Beaufort investigations of inestimable value to our fisheries industries.

Professor Holmes organized and directed the Department of Mines and Metallurgy of the Louisiana Purchase Exposition in 1904. He was in charge of the United States Geological Survey laboratories for testing fuels and structural materials, at St. Louis from 1904 to 1907, and at Pittsburg since 1908. For several years he has been chief of the technological branch of the United States Geological Survey, in charge of the investigation of mine accidents. Since his employment by the national government he has not only continued his work for the improvement of public roads, but has made a more than national reputation through his enlightened efforts to prevent waste in utilization of the country's mineral and fuel resources, and to safeguard the lives of miners.

His investigation of fuel resources alone, began at the St.

Louis Exposition, gave him prompt international recognition, and he was decorated by the governments of Germany, Belgium, Italy and Japan. In recognition of this work, the University of Pittsburg conferred on him the degree of doctor of science, and at the commencement of 1909 the University of North Carolina made him a doctor of laws.

Dr. Holmes is a conservationist of the type of Garfield and Pinchot and is an administrative officer of rare ability. He has the rare gift of selecting the right man for a given piece of work and leaving him to do it in his own way, under no circumstances burdening himself with the details of tasks which the men he chooses are fully competent to carry out. This was admirably illustrated in his investigation of fuels at St. Louis, at Pittsburg and at the Jamestown Exposition, as well as in his survey of methods of conservation of resources and protection of human life in use in the older mining communities of England, Germany, Austria and France. His work along these lines was so thoroughly done that mine owners and employes alike petitioned for the establishment of a permanent bureau of mines, and no one of them ever imagined that anyone but Dr. Holmes would be considered for chief of the bureau. When the organization of the Bureau was intrusted to other hands, such a cry of indignation arose throughout the mining districts of the entire country that President Taft could hardly have done otherwise than give the permanent appointment to Dr. Holmes.

He cannot be better described than in the words of Dr. C. Alphonso Smith, when presenting him for the degree of doctor of laws at our university commencement as "A man of seasoned common sense, of winning personality, and of practical efficiency in all that he undertakes."

Chapel Hill, N. C., Sept. 22, 1910.

EARLY ENGLISH SURVIVALS ON HATTERAS ISLAND*

In the *University of North Carolina Magazine* for February last, Mr. Collier Cobb gives some interesting examples of survivals of old-time speech and manners in a corner of the United States which has, to within the last few years, remained surprisingly untouched by modern influences, viz., the sand reefs of the North Carolina coast, particularly Hatteras Island. Before the advent of motor boats, just a decade ago, this formed a sort of World's end, three days' journey from anywhere, and its mild-mannered people were living under much the same conditions as three centuries ago. Hatteras island is an elbow-shaped sand-spit, 40 miles in length measured around the elbow, and from half a mile to 5 miles in width. It lies along the very border of the continental shelf, 100 miles beyond the normal trend of the coast, between 35 degrees and 36 degrees N. Lat. The everyday speech of the people contains words and expressions familiar in old English usage, but, so far as the writer is aware, hardly to be met with in any part of the United States at the present day. Such are: the verb to travel (in the sense of to walk as opposed to any other kind of locomotion); acre (in the sense furlong); country (meaning the opposite mainland, as opposed to the islands); and many others. The first named is to be found so in Hakluyt's 'Voyages,' and is still to be met with in various corners of the British Isles. Old English melodies are still to be met with in Hatteras Island, though the songs of the mothers and grandmothers are well-nigh forgotten by the daughters. The writer holds that the lost colony of Roanoke may have found refuge there, while the above survivals might also bea ccounted for by wrecks known to have taken place in this locality in 1558 and 1590. It may be regretted that the levelling influences of "civilization" are already making even Hatteras like the rest of the world.

*Reprinted from *The Geographical Journal* (London: The Royal Geographical Society), September, 1910.

CORRECTIONS.

Professor John F. Lanneau has requested us to publish the following correction: In Proceedings of the N. C. Acad. of Science, Vol. 26, No. 2, p. 57 of this Journal, paper on "The Locus of a Moving Point, etc.," sentence "If K-1, the circles are of infinite radius, and are tangent at O," the clause should read, *and pass through O.*

Insert map of The Landes and Dunes of Gascony to face p. 82.

P. 82, line 2: for *feattres* read features.

P. 83, line 27: for *insolated* read isolated; line 35, omit fifth word; line 37, for *upply* read supply.

P. 84, line 2: for comma place period at end of sentence; line 7, for *Pineaster* read *Pinaster;* line 14, for *popular* read poplar.

P. 85, line 12: for comma place period at end of sentence; line 26, for *steritity* read sterility; line 31, for *insolated* read isolated.

P. 87, line 2: for *inalnd* read inland; line 24, for *eastern* read western.

P. 89, line 15: for *ses* read ces; line 24, for *solid* read sand.

P. 90, line 3: for *it to* read to it.

P. 91, line 5: for *end* read and.

In sketch of Joseph Austin Holmes, p. 167, line 2, insert *influenced* after *heredity.*

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